The American Biology Teacher

VOL. 2 OCTOBER, 1939 NO. 1

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THE AMERICAN BIOLOGY TEACHER

Publication of The National Association of Biology Teachers.
Issued monthly eight times during the school year from October to May.

Publication Office—N. Queen St. and McGovern Ave., Lancaster, Pennsylvania.

Correspondence concerning manuscripts may be addressed to any of the Associate editors or directly to the editor-in-chief.

Entered as second-class matter October 26, 1938, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

The American Biology Teacher

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The Relationship of Biology to Other Sciences and to Education as a Whole

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Before we can deal with any phase of this problem we must clarify our thinking as to what our general ideal for education is. We, the educators to our youth of today, must ask ourselves seriously, what are we trying to do for our boys and girls? There is general agreement that we want to help them to know how to live now and in the future. We want them to become physically fit, to be able to establish happy and wholesome social relations, and feel the peace and joy of emotional security. We want them to develop poise and assurance, because they feel a security in their friendships, and thus place at their disposal a means to get along happily in life.

Granted that this is our goal we can scarcely justify a place for subject-matter or facts which are unrelated to "living" on our program. If we are to attain our ideal we will soon discover that ours is not an easy task. There is no Utopian recipe for us to follow accurately which will in every instance give us the prescribed results. Why can we not develop such a formula? Simply because as soon as we stop to think, we come to the realization that in this job of educating the youth we are constantly dealing with variables, which fact at once eliminates routine procedure. How can we proceed then to secure these objectives which we have placed before us? Obviously we must tap all subject areas and from the warp and woof at our disposal weave a different pattern for each individual.

What is Biology and how does it fit in this picture? The entire field of Biology is concerned with living organisms, with the conditions under which they function best, with their interdependence, their adjustments to their surroundings, and with constant environmental changes.

Every boy or girl wants to be a healthy, happy, useful, efficient and cooperative organism. During the adolescent period, the student longs for recognition and approval from friends, teachers and parents. Picture these eager and energetic individuals in a class-room, discovering that all the discussions, experiments, and projects are to be related to and based upon life, the child's life, helping him to better understand his place in the general scheme, what he must do, and what he must avoid doing if he is to survive and to be successful in this continual "Struggle for Existence." Here you have a natural setting for a vital and fundamental interest.

From frequent questionnaires presented to biology students, to which they need not attach their names, and which we can reasonably feel is a frank expression of their opinion, we learn that a significant phase of the work is the chance to verify or to disprove in the laboratory much that they read or hear about. There is a constant clamor for more work of this nature and many students bring in their own materials and outline their own investigations. The microscope opens a new world to them. Time doesn't drag when they observe a paramecium eating, giving off waste material, engaging in a combat with some other animal, reproducing, or just moving rapidly from one place to another. Here is a good chance to do some thinking and to arrive at logical conclusions. Do they move so rapidly out of the field of vision because they are searching for a new food supply or because they are reacting to a certain stimulus? Why is it possible for them to dash up to another protozoan and almost at once this second protozoan is slowed down in its movement and forms a morsel of food for the paramecium?

The birth of a butterfly or a moth from the chrysalis or the cocoon affords a splendid teaching opportunity. Why did the caterpillar eat so many of the milkweed leaves with which they were supplying it? Witness the profound mystery of life when this larvae changes to the beautifully colored chrysalis and then hangs motionless for several weeks. One morning they discover that the green is turning dark and then several days later they see the butterfly emerge. How tired and helpless it seems. The warm sun soon changes it into an active beautiful butterfly. After such an experience the general reaction is one of protection of these insects.

How does food get to all the cells in the body of a complicated plant or animal? The process is much easier for them to understand when they see the effects of a salt solution, and then of fresh water upon the pink cells in the epidermis of a canna lily leaf.

The study of bacteria offers a rich opportunity for clear independent thinking unswayed by propaganda and emotionalism. It surprises the class to discover that many are friends of man and that frequently these small organisms cooperate with man and with other plants and animals for mutual good.

The modern natural science laboratory is truly a museum. Here you may see specimens of beneficial insects, of harmful ones, you will find housed a variety of living plants and animals which are fed and cared for by the boys and girls.

Just the other day a boy brought the end of a pineapple, which he had made grow in a water solution, to class. For many weeks, after he had placed the end of it in tap water, he had watched it for

signs of growth. None seemed to appear. Then one day he learned what digestion was and that soluble salts were taken in for food by plants. He went home, took some rich soil, poured water upon it and shook it vigorously. When he thought the salts should be dissolved, he let the soil settle and used the water for his pineapple. Now he didn't have to wait long to see a root system develop and to see several sprouts beginning to grow. He just had to share his discoveries with the class. His success afforded this boy much joy and developed a confidence in his own undertakings, and incidentally helped him to master a fundamental concept.

This morning an osage orange, a pair of field mice and a grey squirrel appeared in the laboratory and not only did the members of the various classes swarm around these exhibits, but the news seemed to spread like wild fire through the school and between periods and after school new faces appeared and the questions they asked would make interesting reading.

Such teaching aids as movies, radio, and projection apparatus offer great possibilities; especially radio, where the writing of script, and the work of production, including sound effects offer many opportunities for beneficial student activities and learning phases. Under the most favorable conditions these devices are a meagre substitute for the laboratory where constantly the individuals are receiving first-hand experiences.

It seems then that it is easy to convince anyone that Biology is vital in discovering how to live Now we must answer the question, is the material found in this field of sufficient general importance to each and every boy and girl to be included in basic or core material or does it have limited significance and should it therefore be considered as an elective? Should it be taught as a self-contained subject or does it easily tie in with the other sciences and with the subject-matter in other areas to give a clearer conception of life and how it functions? When these two questions are answered a third one immediately confronts us. How is all this material going to be selected and lastly what type of organization and administration will lend itself best in presenting it to the student?

In all learning our first concern is the boy or girl and where can a boy or girl learn more effectively about life and how to live than from the experiences he receives from dealing with various organisms personally, both within the classroom and out in the open where these organisms are living in their natural environment?

Can Biology alone meet all the requirements? Let us consider the environment to which the individual must constantly adjust himself. We see at once that these surroundings involve two factors—the physical and the biological. The physical deals with air, water, typography, soil, sunlight, oxygen, carbon dioxide, winds, temperature, gravity, machines, radios, etc. Chemistry is needed to give us the properties, composition and types of pollution of water, while Biology reveals to us the life, whether friendly to man or of a parasitic and harmful nature. An eclipse of the sun, at one period in history, filled mankind with fear, now with the aid of Physics and Astronomy, we welcome this phenomenon and view it with intense interest.

Man's physical and ecological problems are the same as those of any organism and

are best answered by applying the methods of science. Man differs from all other forms of life in that he has the capacity to think. This mental life has created the fields of fine arts, music, literature, philosophy, religion, entertainment, and has vastly extended the field of science. Here indoctrination, which can play a useful part in education, can make the most harm. It is our duty to make individual growth in intellectual life possible, so that the boy or girl can choose freely what he wishes to do and may even become a specialist.

Every man needs to see his way clearly, to do as much thinking for himself as possible and to be able to protect himself from propaganda and superstition.

Man's ability to think also gives him a new method for solving his problems, the intellectual method. This involves recognizing the problem, analyzing it carefully to determine its cause, and experimenting to discover effects and finally, from observations, inquiries and experiments, arriving at some conclusion. This tends to develop a reasoning individual instead of an emotional one.

Now we come to our real problem. We find that Biology is necessary in understanding life, but the other sciences must be included and then all the other areas must be explored and the vital material must be selected.

Are we meeting this problem satisfactorily at the present time? Does the basic core material presented by a single instructor solve the problem, or is it necessary to have trained educators deal with the materials in their various fields? It is a large assignment to expect any instructor to be adequately equipped with sound information in all the fields of learning, especially since most of these teachers received their training in the old school and have become efficient specialists.

In several schools they are trying a plan which seems commendable. A group of teachers representing as many lines of endeavor as are deemed necessary get together and from all the sources try to select that material which in their judgment is helpful and necessary to aid the boys and girls to live now and in the future. The administrative problem is handled in such a manner that each teacher presents the material with which he has had the larger experience.

At least this is a beginning in the right direction and I'm sure all of us would welcome any information which would help us to deal more efficiently with this problem, the solution of which we are eagerly seeking.

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BACK COPIES

A limited number of back copies of The American Biology Teacher are available. Numbers 4 to 8 (January–May, 1939) of Volume I may be secured for fifteen cents per copy, remittance with order, from P. K. Houdek, Secretary-Treasurer, Robinson, Illinois.

A Biology Unit Dealing with Racial Attitudes

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In view of feelings of racial antagonism now prevalent in various parts of the earth, and their effect on racial groups residing in certain localities of the city, an attempt was recently undertaken at Benjamin Franklin High School to determine whether it would be possible to so affect the students' attitudes that they would be tolerant of and sympathetic towards racial groups other than their own.

With this end as the goal, a special unit dealing with the topic of intercultural and racial relations was prepared for use in most of the departmental subjects. The problem was a particularly interesting one as applied to Biology. Here, a wealth of material on scientific basis for race and analysis of racial beliefs was available.

In order to introduce the problem of race into the Biology course, it was first necessary to select the portion of the regular syllabus into which this work could be logically fitted. Because the sections dealing with Evolution and Eugenics relate to the development of man and his attempts at self-improvement, it was felt that it would be best to discuss this racial unit immediately at the conclusion of these sections.

The important work was to construct a unit which would develop the concept of race from the scientific viewpoint, and also to objectively analyze current conceptions of race supremacy. Questions such as these would have to be answered in the course of the classwork:

On what basis is man classified into groups?

Is there a pure race?

What is the Aryan myth?

Are some groups of mankind more advanced physically in the scale of evolution than others?

Are some groups of man more intelligent than others?

What causes a nation to consider itself superior?

Can so-called inferior groups of man offer contributions to civilization?

In developing this unit, an analysis was first made of the physical basis for the classification of man. This led to a discussion of the basis of the idea of a pure race. A logical consequence of the preceding was the consideration of the Aryan myth and the fallacies arising from it. Also taken up was the basis for the attributed superiority of one race over another because of physical and mental characteristics.

The conclusion was drawn that there are no basic differences among races, but that environment and prejudice, as well as feelings of patriotism are important factors in racial antagonisms; and that racial minorities will make contributions to civilization if given equal opportunities.

An outline of the unit is herewith presented with the recommendation that Biology teachers will use it in their classwork. It is suggested that these books be

used as source material: "Race Differences" by O. Klineberg; "We Europeans" by Huxley and Haddon; and "The Mind of Primitive Man" (1938) by Franz Boas.

It might be stated in conclusion that throughout the teaching of the unit, the appeal is factual rather than emotional; and that the conclusions are drawn after the facts have been presented and examined. With the development of a critical attitude in our students based upon scientific inquiry, we can help render them immune from appeals to racial consciousness which are cloaked by a veil of emotionalism.

RACIAL UNIT

The Scientist Recognizes No Basic Differences Among Races

Topics	*Suggested Procedures*
I. Position of man among the animals	
1. Man as a vertebrate; mammal; primate	review
2. Characteristics of primates	project pictures of primates
3. How man differs from primates	brain size; chin; lips; hairiness; length of limbs
4. Homo sapiens	one species of man
II. Classification of modern groups of man	
1. Differences within the species	skin color; hair color; eye color; hair form; nostrils; lips; head form; height; etc.
2. Further classification of man on the basis of these physical differences	characteristics of the Caucasian, Negroid and Mongoloid stocks
3. Further classification of the Caucasian stock into various types or "races"	characteristics of the Mediterranean, Alpine and Nordic types
III. Race Purity	
1. Where are these types situated geographically?	from above
2. What do people from these countries look like?	examples of students in class; project pictures from the book, "We Europeans"
3. Causes of wide variation	migration, interbreeding
4. Is there a pure race?	conclusion from above; also mimeographed material from "Race Differences" pp. 22–24
IV. Misconceptions about race supremacy	
1. Language	
a. confusion between language and physical differences as basis for classification	elicit
b. Aryan myth	mimeographed material from "We Europeans," pp. 118–121
2. Physical Differences	
a. Negro characteristics which are ape-like	nose; long arms; "Race Differences," pp. 33–35; 36; 75–77
b. Similarly, Caucasian and Mongoloid ape-like characteristics	hairiness; thin lips; straight hair

c. Each group shows advanced development of certain features ..... Negro lips; long legs; little hairiness; etc.

3. *Mental Differences*

a. What makes man superior to the other animals? ..... elicit

b. Intelligence tests indicate that some people are more intelligent than others ..... examination of intelligence test

c. Results of I.Q. tests ..... Negroes, Italian immigrants do poorly on such tests; "Race Differences," pp. 153–189

d. Environment has an effect on I.Q. results ..... comparison of Negroes from the south with those from the north (*ibid.*)

V. General Conclusions

1. Patriotism a cause of feeling of superiority ..... elicit; also mimeographed material from "We Europeans," pp. 44–46

2. Equal opportunity for all types of man (races) results in their contributions to civilizations ..... examples from all nationalities, including Negroes (scientist-Carver; singer-Anderson) etc.

RENEW YOUR MEMBERSHIP

A renewal blank is enclosed with this issue. At least three per cent of the membership fee will be lost to the association if it is necessary to send an individual statement to each member. A number of members have already paid one or more years in advance. This practice not only reduces the work of the officers but saves our funds for the activities of the association. Use the blank. Send in your dues now and save your association the expense of sending you a bill.

Members who have already paid their dues for 1939–40 may use the enclosed blank to enroll a new member.

Members who are also members of a local affiliated biology teachers association may use the renewal blank to remit their dues through their local officers.

AMERICAN EDUCATION WEEK 1939

The 1939 American Education Week observance will be held November 6–11, 1939. "Education for the American Way of Life" is the general theme. As in previous years the National Education Association has prepared materials to assist schools in planning for this observance, including colorful posters, leaflets, stickers, and packets containing special folders for the different school levels prepared by field committees in various sections of the United States. Useful alike to the classroom teacher, principal, superintendent, or American Education Week committee. Early planning will help you make your observance most effective. For complete information, write to the National Education Association, 1201 Sixteenth Street, N.W., Washington, D. C.

Vitamins—The Modern Miracle

JOHN C. GOFFIN, M.D.
Health Education Unit, Los Angeles City Schools

Vitamins—the very name is spectacular—have captured the world's imagination. The marvel wrought by these mysteriously elusive chemical compounds in snatching men, women and children from hopeless invalidism, even from surely impending death, rival the fabled tales of Aladdin and his lamp.

An emaciated maniac with swollen red tongue and scaly skin, dying a lingering death from pellagra, the "hard times disease of the South," in a few days is restored to health and sanity by magic pills of nicotinic acid. Pellagra claims 400,000 victims in the United States each year, and of these about 8,000 die.

A feeble paralytic with failing heart and swollen, paralyzed legs, suffering from an advanced form of beri beri, the scourge of the Orient, is made normal again in a marvelously short time by a man-made compound named thiamin, or vitamin B_1.

A twitching, irritable, whining infant with spongy, bleeding gums and the hemorrhagic joints of scurvy is soon changed into a placid, smiling, healthy-looking baby by ascorbic acid, vitamin C, the protective element in orange, lemon and tomato juice.

Such are just a few striking examples of what these wonder-working substances will accomplish in human beings whose diets have been deprived of them for too long a time. To the uninitiated these phenomena are far more miraculous than the Biblical laying on of hands and the cures wrought by the saying of magic formulae.

Is it any wonder that vitamins have pushed many of the catharties, pain killers and tonics off the druggists' shelves, that there are hundreds of pills, tablets, capsules and ampoules, and scores of combinations of vitamins for sale both to the medical profession and to the lay public?

And yet all these miracle-workers may be found in the products of our farms, gardens and orchards, activated by the sunlight that bathes our bodies—found in infinitesimal amounts to be sure—but in sufficient quantities for health.

The trouble is that man in the process of becoming civilized has industriously milled, processed, boiled, frozen, and otherwise extracted many of these essential components from his natural food. Primitive man, eating raw, natural foods, animal and vegetable, had no need to worry about vitamins, minerals or roughage. Civilized man, having removed them, is faced with the necessity of retaining them or putting them back in his food.

The cases just mentioned and others that might be cited to illustrate other deficiency diseases and their cure by vitamin therapy are extreme examples, yet there are many thousands of similar cases. In addition, millions of adults and children suffer from partial deficiencies—not severe enough to kill them or even put them to bed, but of such a degree that growth is retarded, resistance to disease is lowered, appetite is interfered with, pains and aches are present, eyesight and the functions of other senses are impaired, and energy and endurance are

depleted.

Nor are these all the factors that result in from one-third to one-half of our population being vitamin-starved. Poverty, with its attendant low morale and ignorance; lack of nutrition knowledge; faddist reducing diets; special diets for all sorts of real and imaginary illnesses; the drain of pregnancy and lactation; chronic diseases that burn up body tissues and vitamin reserves; chronic alcoholism—all add their victims to the army of the vitamin-deficient.

There is yet another reason why people flock to the drug stores for vitamins: in addition to the reputable pharmaceutical houses, dozens of commercial interests, putting profit before public health, capitalize on the hopes aroused by spectacular deficiency-disease cures and advertise vitamin preparations whose potency is at least questionable and whose claims are spurious and fantastic.

Vitamins cure diseases caused by lack of vitamins. They don't alleviate symptoms produced by other causes. Because an adequate diet containing certain vitamins helps to fortify the body against colds, some people believe that vitamins added to their regular diet will prevent or cure colds. Since an adequate vitamin intake helps to preserve energy and endurance, many fondly hope that—being "below par"—all they must do to regain the vigor of youth is to swallow a few vitamin tablets, and presto, all their physical ills will vanish!

It is not so simple as that. In fact, it is not simple at all. Even physicians at times are hard put to it to decide whether a given patient is deficient in vitamins and if so, what vitamin or vitamins he is deficient in. This is true because the methods of accurately estimating mild deficiency are not yet perfected. The clinical symptoms of mild deficiencies are often complex, vague or obscure. They are frequently masked by symptoms of protein deficiency, mineral starvation or abnormal functioning of the endocrine glands—that orchestra of inconspicuous but vital set of organs of which the pituitary is the conductor and the thyroid, the parathyroids, the adrenals, the thymus, the pineal, the pancreas and the sex glands are the other performers.

In fact, if our endocrine glands are not properly doing their work or if they are overworking and if we are not receiving adequate amounts of essential minerals, we may be eating all the vitamin-containing foods a normal human should require but we will not be absorbing or fully utilizing those vitamins. They will be excreted in the urine and by the intestines unchanged instead of being built into our body cells. A classical instance of this lack of utilization is the vitamin D—calcium—parathyroid triad. Without normally functioning parathyroid glands and vitamin D, calcium will not be built into bones and teeth. If there is a lack of calcium or parathyroid extract, or both, vitamin D does us little good. These three chemicals are thus mutually interdependent.

In exophthalmic goiter the thyroid gland is overworking—functioning at top speed—burning up tissue so fast the individual becomes half-starved no matter how much he eats. The vitamin intake of such a patient cannot be met by a normal well-balanced diet alone.

Adequate iron and copper intake also is essential for normal vitamin utilization. The anemic individual must be built up with these essential minerals as well as having his vitamin ration supple-

mented. In fact, if he is low in iron, he will not utilize vitamin B.

It all boils down to this: if you are ill, whether you are flat on your back or just mildly out of sorts, don't diagnose your own case as vitamin poverty and rush pell-mell to the pharmacy for neatly labeled synthetic vitamins, but put yourself in the hands of a physician and let him study your case thoroughly, investigate your daily habits, especially your eating habits, and prescribe for you on the basis of his findings. It may be that you do not need vitamins at all, or if you do, that some essential food you have been overlooking or abstaining from under the delusion that it didn't agree with you will be all you need to put you once more on the smooth highway of health.

Does all this mean that we shouldn't bother our heads with a lot of highly technical knowledge of the vitamins, their names, in what foods they occur, what vitamin deprivation will do to us, etc.? By no means. It is just this lack of knowledge, this failure to eat intelligently, that causes so much mild and not so mild vitamin deficiency today. We need to understand these things—not as the laboratory chemist or dietary expert understands them—but we do need a working knowledge. When the poet said, "a little learning is a dangerous thing," he was being alliterative rather than accurate. No doubt he meant judgment rather than learning. Even a slight inoculation of knowledge should produce some immunity to error.

Knowledge of the vitamins has blazed forth on a smug world, satisfied with its nutritional concepts, like a comet in a murky sky. During the past quarter century discovery after epoch-making discovery has revolutionized our traditional thinking along dietary and biochemical lines. Biologists are concerned with life processes, at the very heart of which are vitamins, enzymes and hormones. An inquiry into the functional relationship of these complex interacters, which modify and condition life processes as activators, reducers, oxydizers, catalysts, would plunge us deeply into the almost uncharted sea of biochemistry. Researchers the world over are studying varying phases of this puzzle and every little while some bit of the intricate pattern is resolved and made to fit. The science of human nutrition, relating as it does to growth, development, metabolism, intellection, senescence and decay, is only in its infancy. In the development of this science vitamins and hormones are destined to play an increasingly important rôle.

A cursory review of the vitamins at present known, their sources, the part they play in health and disease, and their relative abundance or scarcity in the modern civilized diet may be of value in stimulating independent study and inculcating appreciation of their great importance.

When puzzled chemists and clinicians called these then-unknown substances vitamines, they intuitively chose a name that scientific analysis has proved to be apt. The alphabetical nomenclature was a mere convenience, much like the x in x-ray. Isolation of the pure vitamins in the laboratory, countless animal experiments and finally synthesis from well known elements by means of which the vitamins were proved to be complex chemical compounds have provided the chemical names that more accurately distinguish them.

Vitamin A, synthesized as a pure white crystalline, fat-soluble compound from carotene, a yellow substance found in many forms of edible vegetation and con-

verted by the liver cells of animals and man into vitamin A, is an unsaturated alcohol, $C_{20}H_{29}OH$, and therefore unstable, readily absorbing oxygen and hydrogen from the air. The vitamin is synthesized from carotene by specialized liver cells and stored in them. Total lack produces degenerative changes in ecto- and entodermal structures, causing in the eye a disease called xerophthalmia and blindness. In children growth and development are retarded and resistance to colds and upper respiratory diseases is lowered.

Food sources of the vitamin in approximate order of potency are: halibut, burbot, cod liver oil, beef or pig liver, whole milk, butter, egg yolk, animal fats. Principal food sources of carotene are: apricots, spinach, carrots, chard, green beans and peas, Brussels sprouts, lettuce, squash, pumpkin and sweet potato.

Many children and adults eat diets deficient in dairy products, glandular products and vegetables. Night blindness, said to be the first symptom of vitamin A deprivation and in which the visual purple of the retina regenerates too slowly on exposure to bright light, resulting in blindness in dim light, is present in 25% to 50% of school children. Pediatricians now advocate cod liver oil during early childhood, especially in the winter months, and routinely in infancy. Many adults would benefit from its administration or from the more convenient haliver oil capsules. In taking cod liver oil one is breaking no rule interdicting self-medication. The fish liver oils are foods.

Vitamin B, once thought to be a single substance, has been proved to be a whole family of vitamins, the two most important of which for man are B_1, or thiamine chloride, and B_2 or G, also called riboflavin.

Vitamin B_1, or thiamin, $C_{12}H_{17}N_4$ OSCL HCL, is a water-soluble crystal and is destroyed by moist heat at 100 degrees Centigrade. Beri beri, a degenerative disease of the nerves and the brain cells, is the inevitable result when thiamin chloride is taken out of the diet. In China and in Louisiana a polished rice diet causes beri beri because the vitamin formed by nature, in the germ of the grain, is removed with the husk in the polishing process. Exactly the same thing happens when wheat is milled into white flour.

Without vitamin B_1 growth is impossible. Children, therefore, require more than adults. Technically a child needs 44 units per pound of body weight for normal growth and development. A partial deficiency results in nervousness, fatigue, lack of energy, poor digestion and general muscular weakness.

Apparently vitamin B is the self-starter of the vegetable world. Since it is present in the germ of the plant, it must be concerned with the growth of the new life that will spring from the germinal portion of the seed. Animals and man store it also in glands, muscles, blood and brain. It is found stored in the egg yolk of birds. The best food sources in order of vitamin value are: yeast, whole grain breads and cereals, liver, kidney, eggs, leafy vegetables (another plant storehouse), oranges and other fruits.

Vitamin C ($C_6H_8O_6$), variously named ascorbic acid and cevitamic acid, is a water-soluble crystalline substance, easily destroyed by oxygen and alkalies, though heat-stable in the absence of oxygen. Because it is such a spendthrift in parting with its oxygen, foods containing it must be fresh and preferably kept at low temperatures. Orange juice should be consumed soon after extraction and not left over-night, though if promptly sealed

in air-tight cans its ascorbic potency is not appreciably impaired.

Vitamin C has several functions in the animal body: it prevents capillary fragility by its action in promoting the formation of collagen, the cell-cementing substance, thus preventing the hemorrhages into the tissues characteristic of scurvy; it fulfils the functions of a respiratory catalyst, promoting oxygen reduction in the tissues; and it cooperates with the body defensive mechanism in repelling the invasion of bacteria. It has been demonstrated to be one of the essentials in preventing tooth decay and in the healing of bone fractures.

The food sources of cevitamic acid are chiefly the citrus fruits: orange, lemon, lime and grapefruit juice and cabbage, tomatoes and strawberries. Many other fruits and a few vegetables contain smaller quantities.

Vitamin D ($C_{28}H_{43}OH$), the antirachitic vitamin, or calciferol, is a highly stable, fat-soluble substance. It is the only vitamin that the human being can manufacture *de novo* in his own body. It is produced by an enzyme in the skin which must be activated by the ultraviolet rays of sunlight.

Complete lack or failure of utilization of vitamin D results in rickets, a deficiency disease still quite prevalent in the United States and too familiar to need description. Partial lack causes retardation of growth, muscular weakness, nervous instability and dental caries.

Foods alone are inadequate sources of vitamin D, unless we include the fish liver oils. They are our best source. Numerous irradiated foods have been marketed, the most important of which are irradiated fish liver oils and milk. The ultraviolet rays from the quartz lamp are used in treating rickets in large smoky northern cities where sunlight is at a premium.

Vitamin G as a preventive of pellagra was discussed in the beginning of this paper. Residents of the south are prone to indulge in a diet consisting largely of hog back and corn pone. A well-balanced diet of eggs, milk, meat, fruit and vegetables will prevent this devastating disease.

Vitamin E, a higher alcohol, $C_{29}H_{50}O_2$, the fertility vitamin, is found in wheatgerm oil, cottonseed oil, olive oil, corn oil, whole grain cereals, legumes and lettuce. Its lack causes failure of embryonic growth and abortion in women and sterility in men. The ancient custom of throwing rice at newly married couples had its origin in the superstition that because grains always sprouted when placed in the ground and were therefore the symbol of fertility, pelting the prospective heads of families with such exemplars should assure the benedicts a large progeny.

Several other members of the growing family of vitamins have been discovered but not enough experimental work has been done on them to accurately appraise their characteristics and functions. As time passes we shall hear more and more of these fascinating chemicals so essential to our wellbeing.

Discovery of the vitamins has taught us that man shall not live by bread alone nor by any other single food. Far too many Americans still think that the foods that "stay with you" are all that are necessary for health. He who indulges exclusively in starches, sugars and meats and scorns whole grains, milk, eggs, liver, kidney, fruits and fresh vegetables is digging an early grave with artificial teeth. His own will have departed long since. Universal application of our present-day nutritional knowledge would do more for the health of this nation than all its doctors and hospitals.

Biological Briefs

RUTH SHERMAN

PETERSON, ROGER T. *Swamps and Marshes.* Bird Lore 41: 225–232. July–August, 1939.

What should be done about our vanishing swamps and marshes? Their value as a means of stabilizing the water supply and of providing haven for many forms of wild life cannot be measured. However, as the encroachments of cultivation, mosquito control measures, and civic "improvement" campaigns continue, these areas are being drained at an alarmingly rapid pace. Many of the localities thus drained have proved useless for farming. Draining swamps frequently lowers the water table of the surrounding areas to a point where nearby ponds and lakes vanish, and plants in these areas can no longer reach down far enough for water. The destruction of feeding and nesting grounds is leading to the rapid extinction of many forms of life adapted only to this type of habitat. In some areas, uselessly drained marshes are now being restored. The author urges that, before further draining is carried out, thorough studies of possible consequences be made.

(*Note:* This is one of a series of excellent articles on nature study and conservation designed primarily for teachers.—Ed.)

MOSS, A. E. *When It Rained Salt Water.* American Forests 45: 414, 432. August, 1939.

The more obvious damage to forest trees resulting from the New England hurricane of September, 1938, has been pictured and described. Some effects, however, were not immediate, but have since evinced themselves. The harm done to conifers by wind-driven salt spray was studied by this author. The needles of white pines were killed, falling off the tree within a month after the hurricane. In some regions, whole trees near the shore and sides of trees farther inland are dead; injured needles have been found 45 miles inland. This was the most sensitive conifer; pitch pines were much more resistant. The red cedar, southern white cedar, and ground juniper were badly affected, as was also the hemlock. Spruces and yew were fairly resistant. In the hardwoods, new growth has been delayed by dead buds. Here the most resistant tree is the horse chestnut; the least hardy, the tulip tree. The real cause of the damage has not been determined, since trees submerged in salt water were not killed. Perhaps salt was forced into the stomata by the force of the wind, or possibly the excessively rapid evaporation immediately after the storm intensified the effect of the salt.

EAST, BION R. *Mean Annual Hours of Sunshine and the Incidence of Dental Caries.* American Journal of Public Health 29: 777–780. July, 1939.

Among the many factors upon which resistance to dental decay may depend, sunshine has so far held a rather questionable role. Upon investigating the incidence of dental caries in white boys from 12 to 14 years of age living in small communities throughout the United States, the author has found a negative correlation between the number of cavities and the mean number of annual hours of sunshine in each area. Directly or indirectly then, sunshine seems to play its part in increasing bodily resistance to the inroads of tooth decay.

PRESIDENT'S MESSAGE

The National Association of Biology Teachers is now entering its second year of activity. We, who brought it into being, felt that there was a real and definite need for a national organization of the biology teachers of the secondary school level and for a journal to deal exclusively with their problems and express their ideas. The enthusiastic reception accorded the association and its amazing growth have justified our belief. Our infant of a year ago has become a lusty youngster. There used to be a saying current with old-fashioned nurses, "look out for the second summer." We, as biologists, have turned our backs on the old superstitious beliefs, and know that it is ceaseless care and attention which carry both babies and associations through all phases of their careers.

Cooperation is an important tenet in the belief of forward-looking science teachers. The cooperation of our members has been largely responsible for the growth of our association. Our journal must become more and more a conference-room where each member may bring his problems for consideration by all and where he may offer helpful suggestions to others, as well as his solutions for the aid of others. In this respect your publication differs radically from most of the educational journals. Although it contains articles by leading scientists dealing with pure science and papers from leading educators upon pedagogic principles, the major content deals with problems that may be applied in your classroom and mine. The editorial board cannot pull these from a hat by magic. They must come from the individual teachers who experience them.

Each state and district organization can cooperate by submitting the manuscripts of the best papers on their programs. These programs perform the important work of an audition to determine whether the talk has material worthy of national recognition.

The National Association of Biology Teachers is anxious to cooperate in any movement to sponsor progress in biology education. It identified itself prominently with the National Committee on Science Teaching of the N.E.A. in developing a complete science program from grades one to fourteen. At two meetings of this committee held in Cleveland in February and May, several of your officers and members were present as consultants. At a meeting at Sarah Lawrence College, in connection with the Columbia Workshop and the Progressive Education Association, your association was represented by your president and several members. We shall have a representative on the committee at all future meetings.

Since the larger our Association becomes, the greater will be its field of influence, each member should cooperate by bringing in at least one new member at the beginning of this important year. Our membership is rapidly growing but our goal will not be reached until a majority of those interested in the teaching of biology in the secondary schools is cooperating with us.

YOUR IDEAS WILL HELP

The officers of your association and the editors of your journal. What type of articles do you like best? What services or features would increase the value of the journal? Can you suggest a project for the association to sponsor? Would you like to have a local biology teachers association organized in your area? Let us have your suggestions. Use the back of your renewal blank.

Local News

ILLINOIS BIOLOGY TEACHERS ASSOCIATION

The annual meeting will be held November 3, 1939, at the University of Illinois at Urbana. An unusually strong program of addresses and discussions has been planned for this year's meeting by Mrs. Grace L. Cook, President of the Association. The principal speaker on this year's program will be Dr. Maude Slye, Associate Professor of Pathology, University of Chicago, who will speak on the topic "Heredity and Cancer." Dr. Slye is an international authority on heredity of cancer, having performed experiments for years in this field.

SOUTHERN CALIFORNIA ASSOCIATION OF LIFE SCIENCE TEACHERS

Plans were made to sponsor two programs on the Los Angeles Teachers' Institute. This Institute is held for the teachers of both the city and country of Los Angeles.

These two meetings were held on Friday and Saturday, September 29 and 30. The first meeting on Friday evening was a lecture on "Utilizing the Natural Interest of Boys and Girls in Life Science." The Saturday morning meeting was a demonstration field trip with an actual class of high school students conducted on the campus of Manual Arts High School in Los Angeles. The leader of these two sessions was Mr. O. D. Frank of the Laboratory Schools of the University of Chicago. Miss Edith A. Kraeft, President of the Southern Association of Life Science Teachers was chairman of the Programs.

MIAMI VALLEY BIOLOGICAL ASSOCIATION

Officers for 1939–1940

C. A. Barker, Chairman, 1017 Cumberland Avenue, Dayton, Ohio.
W. R. Piper, Vice Chairman, 331 Summit Street, Troy, Ohio.
Miss Miriam Pauley, Secretary, 2113 Emerson Avenue, Dayton, Ohio.
C. A. Trimble, Program Chairman, 215 East Second Street, Xenia, Ohio.

Schedule of Meetings

September 9 (Saturday).
HOCKING COUNTY CAVES (OHIO).
11:30 A.M. Picnic Lunch at Rock House.
12:30 P.M. Hike through the gorge. Leader Mr. Edward S. Thomas.

October 2.
PUPIL PROJECTS IN NATURE STUDY.
8:00 P.M. An "experience" meeting and N.A.B.T. promotion. Dayton Power and Light Auditorium, East Monument Avenue.

November 13.
HOW THE MUSEUM CAN HELP.
8:00 P.M. Dayton Public Library Museum, East Third at St. Clair. Sigmund Metzler, Director, and Kenneth Dearolf, Assistant Director, of Museum.

December 4.
WILD LIFE CONSERVATION.
8:00 P.M. Kuhn's Building. South Main Street at Fourth, Dayton, Ohio. Mr. R. O. Samples, Conservation Officer, Leader.

(Continued on page 30)

A New Frontier: The Reconstruction of Teacher Education

C. L. HUGHES
Assistant Professor of Education, University of California, Berkeley

The *quality of teaching* is the basic element in an effective program of education and this, in turn, obviously depends upon the *quality of the teacher.* Now, a discussion of the quality of teaching implies a specific point of view toward the process of education. Likewise, specific characteristics and values may be attributed to the process of education, according to one's view.

Thus, one kind of school may be characterized by rigid, unquestioned discipline with the teacher in the role of taskmaster; by emphasis on subject matter, with little or no reference to needs, interests or abilities of its students, and by a lack of interest in a changing world. The values in this kind of school are based on an authoritarian philosophy, a mechanistic psychology and a static society. Quality of teaching, it seems from this viewpoint, exists to the degree that the teacher is master, that strict obedience is attained, that lessons are memorized and that the school remains insensitive to social pressure.

In contrast, another kind of school may be characterized by cooperation of pupil and teacher on a footing of mutual respect and helpfulness in matters of conduct and school government, by the use of subjects, materials, and activities as means of satisfying needs and developing interests and abilities of students, and by attempts to help students understand the world in which *they are* a part. The values of this second kind of school are based on a democratic philosophy, a functional psychology and a dynamic society. Quality of teaching in this kind of school is evidenced by the high morale of its students and teachers alike, by their keen interests and delight in the numerous activities of the school, by their willingness to share responsibility, and by a concern for their own growth and progress as individuals, as well as a genuine concern for the growth and progress of their school.

There is no need for further elaboration upon either of these viewpoints of the function of the school. It is enough for us to recognize that there are still too many schools resembling the first type and that schools of the second kind are just coming into being, in the interest of a more suitable education for our modern day.

The main point of attack for improvement has been on the curriculum. In practice this means that a few favored schools have made some significant changes, not only in *what* they teach, but likewise in *how* they teach. These "favored" schools have had no easy task, even though they have had diligent leadership and a few teachers who were intelligent and willing to "experiment" with change. These attempts deserve a tribute but progress toward fundamental change will continue to be irregular and spotty until we recognize that the basic problem lies in attaining a quality of teaching consistent with today's individual and social needs. To develop this concept of quality of teaching we must keep in mind our opening assumption, that an effective program of education depends basically

on the quality of the teacher. It may seem trite to urge this point, but the fact is that, by and large, we go right on educating teachers as if the desired quality of the teacher had little or perhaps nothing to do with a changing school.

Here, then, is our frontier: the reconstruction of teacher education. To recognize the *need* for reconstruction is only the beginning of a series of complicated problems. One might think the matter simple enough if all that was needed was to effect new requirements, but this attack is too much like tinkering with the curriculum to gain reforms in the process of education when, in reality, the difficulties lie very much deeper. The scientist who wishes to perfect a strain in some plant or animal must control selection of stock if his end is to be accomplished. Similarly, institutions for the education of teachers must set up better means for the selection of candidates for teaching credentials. Although this is fundamental, any person engaged in the education of teachers knows at the outset that it is a difficult and complex matter. The problem is not alone one of setting up objective criteria but more particularly one of determining subjective criteria. That is to say, it is relatively easy to set up knowledge and scholarship requirements as standards for selection. On the other hand, it is around the personal equation which is so important in teaching that a host of difficulties arise.

Foremost among these difficulties is the refutation of several common notions of long standing. The first of these notions is that *any* person has the *right* to be a teacher. It seems never to occur to some candidates that they are not suited, personally, to be teachers. Their main concern is to satisfy, by hook or crook, whatever requirements they *must* meet as set down by law. Even then, some very grudgingly comply, looking upon these requirements as obstacles in their way of obtaining a livelihood. One rarely hears of a student who has been debarred from entering a medical or law school feeling that he has been deprived of a God-given right to be a physician or a lawyer, even though the basis for exclusion may be quite arbitrary. Just let a school of education attempt to bar a person whose case they have considered thoroughly and found personally unsuited for teaching and it is in for all manner of threats and abuse!

The second prevailing notion concerns *rehabilitation*. In some quarters it is felt that one of the main functions of a school of education is to be a refuge for all sorts of physical, mental and academic derelicts on the campus and that it is their job to make such "problems" over into teachers! Arguments, of course, are that teaching is easy: short hours, long vacations, lack of strain on one's physical and mental equipment. Such statements are born of sheer ignorance. There are lazy teachers, to be sure. However, the teacher's work, if it is conscientiously done, is *hard* work and the schoolroom is no place for a weakling.

A third notion is that teaching is a *makeshift* occupation. That is to say, it will do until something else "turns up." If we are to have teachers of quality this notion must be supplanted by the concept that it is a career worthy of long and arduous training, to be undertaken only by those who look forward to at least a fairly long period of service in it.

There are two points to be drawn from the foregoing discussion on selection of candidates for teaching. The first is simply this: We cannot possibly hope to recreate education into a vibrant, dynamic process suitable for supplying the needs of young people living in a complicated world unless we recruit for the service of the schools the very best

college material available. The second point is concerned with one means of helping to accomplish the first. Institutions charged with the responsibility for the education of teachers should be given *real* power to exclude those who, in their opinion, are not suited to a career as capable teachers. Now this is a matter of judgment, sometimes entirely apart from mere objective standards, and one in which the question of personal qualifications merits serious consideration. Although many school codes imply the right of an institution to exclude because of lack of personal fitness, state institutions are wary of exercising an implied prerogative because such actions may be followed by threats and abuse or perhaps, a law suit. An institution's position is also weakened sometimes when a state allows persons to seek certification through a direct application without reference to the approval of an institution. Oftentimes, this permits pressure to be brought favorable to a candidate not in the interest of fitness but because, very often, of "politics."

These remarks, we admit, do not cover all the problems with which the selection of candidates is concerned. On the contrary, the points mentioned are ones frequently overlooked in a discussion of this question and ones which we believe are basic to the selection problem. We will have gone a long way in improving the quality of candidates if we can attract unselfish, intelligent, interested and well-balanced young persons capable of profiting from a teacher education program organized specifically with a new type of school in mind.

The second part of our problem of the reconstruction of teacher education is concerned, obviously, with the program itself. In some respects, this question presents even more baffling difficulties in the path of reform than those involved in selection. At the outset, there exists a sharp conflict among the personnel of the training institution in the interpretation of "quality of teaching" and "quality of the teacher." Those instructors in academic fields who have given the question any consideration at all, usually have very pronounced views on the subject. "Quality of teaching" in their minds is simply a matter of seeing to it that students learn their "lessons" in a manner acceptable to the teacher—if this doesn't follow, then it's just too bad for the students. "Quality of the teacher," in their view, is measured almost wholly by scholarly attainments. There the matter ends as far as they are concerned. They fail utterly in most instances to recognize the real needs of the secondary school in terms of the demands placed upon teachers in these schools. To a discouragingly large number of university instructors the secondary school is nothing more than a college preparatory institution. Yet, to their credit it must be said that, for the most part, they are competent, sincere and enthusiastic about their respective subjects and wish to make their instruction effective for the training of future teachers. However, these very characteristics have led them to a philosophy of teacher preparation which glorifies academic scholarship as the sole essential for teaching success. It must also be noted that, even if college teachers desired to emphasize their own teaching activities in the interests of a program in accord with changing demands, they are blocked by the pressure of research. Their prestige among their colleagues and the scholarly fraternity generally (incidentally the prestige of their university) is largely determined by their fame as research men. All too often the only means of gaining promotion or salary increases lies in research ability. The only sensible solution, it seems, is simply that university officials recognize that the teaching function of a univer-

sity *is* important enough to warrant recognition of faculty members for teaching ability as well as for research ability. These two abilities do not always go together.

This point of view on the part of college teachers is, in our opinion, the basic difficulty in the reconstruction of the program for teacher education. The program as such must be reformed considerably if we are serious about the reform of secondary education. It does not necessarily follow that the common arrangement of courses for the "Liberal Arts Degree" is either liberal or the best possible program for the education of prospective teachers. Often there is either too much specialization or if there is "spread" it consists merely of a patchwork of courses, lacking continuity or interrelation and correlation of work. All teachers should have a general basic education, irrespective of their "special" fields of interest. It is sad to report that the results of current affairs tests given to prospective teachers show an appalling lack of knowledge of personages and events, to say nothing of their significance, making up the present-day literature of a world in review. In addition to general knowledge and understanding, the prospective teacher should learn to see his job in terms of his contribution to the growth and development of his students. His own field of interest, as represented by some segment of human knowledge, must be thought of as *his way* of helping to bring about the proper "growing up" process through which the youngsters in his charge are passing, and not merely as a learning end in itself. It should be every teacher's concern, just to mention a few illustrations, to facilitate growth in expression, to promote courtesy and consideration for others, to develop ability to study and work effectively, to assume responsibility, etc.

The professional side of the teacher's education needs, likewise, a number of changes. An earlier contact with the real work of the teacher is much needed. It is extremely difficult, if not impossible, to "make" a teacher of real professional spirit in one or two semesters that are grudgingly given schools of education after candidates have already spent three-fourths or more of their time in preparation elsewhere on the campus. This does not imply, necessarily, a recommendation that more courses in education be required. It means, primarily, that some contact should be made with prospective teachers earlier and that through this contact, whether it be by means of a course or by a counselling system, the functional point of view must dominate. Laboratory work and observation, with much more expert direction and supervision, must take up a considerably larger amount of the professional program, than it does now.

In conclusion, it should be emphasized that the task of reconstructing the teacher education program should be looked upon as a matter of concern for a whole university. A school of education alone, however conscientious, cannot hope to accomplish results of large consequence. It is in this connection that we shall look to the departments in subject fields who must furnish the ground work in knowledge and understanding of the great division of human endeavor. Science departments, in particular, which contribute a large number of future teachers should find in this a challenge, since the background which they give contribute so much that is needed in the secondary school today. A frontier such as this requires a concerted attack, involving unprejudiced cooperation and willingness to share in the responsibilities which the many difficulties entail.

Adventures in the Classroom

RUTH A. DODGE

So often in the classroom as you glance at thirty or forty faces, all seemingly interested in the subject at hand, there comes the realization that at best only a small number can fully understand the underlying principles, a few more can learn the facts presented, but to the rest it is only a passing show or a pleasing performance.

Thus it is a challenge to every teacher to so plan the supplementary material, arrange and direct the laboratory experiments and lead the field excursions that each student may receive the greatest benefit.

Projects perhaps lend themselves more readily than other means to care for individual differences since a great deal can be expected of the superior child while a slow student may be unable to complete anything of real value.

Over a period of time projects have been carried out both individually and as class problems. It has been found that individual projects or those done in small groups of two or threes are the more satisfactory since each is called upon to use his own initiative and resourcefulness in producing something useful to the class or department. In class projects the better students lead and often the poor student becomes more conscious of his weakness.

It may prove helpful to make an annual survey of museum specimens, charts, models, booklets and bulletin board material classified according to units and topics covered in the course of study. Inferior work can be removed from the regular files and a list of suggestions for projects for the coming year can be mimeographed. Students will thus be guided in their selection of topics but not necessarily limited to the list. This with the revised library list of supplementary reading should prove useful.

Even with the help of such material the teacher has a real problem to stimulate interest in the various topics and to encourage the students to put forth their best efforts.

During the time that this has been tried it has been found that certain types of work have a greater appeal to different classes of students.

1. a. *The superior child* usually likes to *read* and in this he can be guided by library reference lists and suggestions by the teacher. He can also be encouraged to search for additional reference material and make guide lists for the rest of the class.

b. He not only likes to care for *living things* but he delights in experimenting with them. One year two boys conceived the idea that they wanted to dissect a couple of their frogs but decided that their pets were too thin, partly because flies had been scarce and partly because of their inattention to food values. Force feeding was suggested. Small pellets of hamburg and chopped insects were given to the prospective victims at regular intervals, the weights of all frogs carefully noted and charts and graphs kept up-to-date. Needless to say, it was with regret that they finally killed, dissected, preserved and mounted their pets which are now in the school museum.

White rats and guinea pigs are often used for feeding experiments. Those

students who found the little rat with crooked teeth, grown thus because of their thoughtlessness in not supplying the proper food will not quickly forget their lesson.

Breeding experiments with most any of the animals serve as a far better teaching medium than text and illustrations. What better way is there to teach parental care than to watch a mother rat discipline her young? Those boys who waited so eagerly for young rats but who did not take the suggestion that vitamins in the diet might be essential also learned by experiment a few practical things. When they were finally convinced of their mistakes and took measures to supply the proper food they were rewarded for their efforts. Perhaps no young rats were heralded with greater joy.

Plants grown in different types of soil, various methods of crossing, budding and grafting are experiments which appeal to the best students.

c. *Individual collections,* aquaria and terraria made and kept at school or at home, insect and flower mounts, are often worthwhile and lead into hobbies.

2. a. *The average student* is apt to be less versatile or else has reached what he considers a happy state and does his work but produces nothing of exceptional value without an extra stimulus. *Reading* for him is of a simpler nature. It may consist of animal or plant stories and topics found in the newspapers. He likes to make excerpts of these, paste them in scrapbooks and think he has something very new unless he is carefully guided and shown how to classify and use his material.

b. *Living plants and animals* interest him the most. He likes to care for them and make their indoor habitats as natural as possible. A young pigeon was brought into the laboratory. This meant design and construction of a cage, learning of food for pigeons, how to arrange for the dropping of temperature during the night, arranging for its exercise and training. Now it is the classroom pet. At certain times it is permitted to fly about and investigate the various objects in the room much to the delight of those who are caring for it. As a result many and varied book reports on birds have been submitted.

A little field mouse was captured alive and has been trained to perform on various types of apparatus the construction of which called for all kinds of ingenuity.

Likewise, during certain hours, the large turtle is allowed to walk about, but the frogs from their mossy banks are not selective in their moments of vociferation. Bees and ants keep active all winter although the salamanders prefer to stay under the moss. The tadpoles are beginning to grow legs. It is interesting to watch the snakes display their remarkable power of locomotion and an unsurpassed sense of balance as they poise on the branches of their trees. Thus even the presence of living things may help toward a better understanding and a love of nature.

c. By the average student who likes *drawings,* many beautiful as well as accurate *charts* have been made. Since the few that were on hand were not adapted to the present course a supply of white linen chart-making cloth was purchased. Drawings were made in India ink and many were colored. The labels were made large enough to be read from the back of the room. Gradually a very useful collection has been made. Other students preferred to use oil or water colors and have made beautiful paintings of habitats and a frieze depicting the life of early man.

Some schools may be fortunate enough to have many models but doubtless others have very few. If you do not have many it is possible that some of the students will like to make some. With some subjects as mitosis or maturation the whole class is divided into groups with various stages assigned to each. The best model of each stage is selected, the series assembled and a demonstration model made, painted, labeled and mounted. Some students delight in making models of animal or plant forms. These are usually made of plasticine, mounted on wood and then painted and labeled. Some make plaster of Paris casts; others use papier maché.

2. a. *The slow student* needs all the additional stimulus he can receive. *Reading* does not appeal to him for it is hard work and does not seem to be worth the effort. Simple books with many illustrations are his choice.

b. He likes the *living material* but is content with the mechanical rather than the experimental side. He may make a good animal cage and collect some living thing but he has to be guided and supervised in every detail. Some of these students are very faithful in routine care of pets but seldom go farther.

c. *Charts and models* appeal to them and all too frequently are not of high quality. But paper is cheap and modeling clay can be used over the next year and if the student can learn to visualize structures by careful comparison and to appreciate the beauty of the symmetry of the form it seems to be worthwhile to encourage him.

These are but a few of the ways of dealing with individual differences. Every teacher has had his own classroom adventure. Perhaps some will draw from their own experiences and send helpful suggestions to all.

BOOKS

CURTIS, FRANCIS D., School of Education, University of Michigan. *Investigations of Vocabulary in Textbooks of Science for Secondary Schools.* New York, Ginn and Co. 127 pages, photoelectric process. $1.40 list.

The author has been working seven years upon science vocabularies. This monograph gives the results of 100 investigations, including 55 masters' theses. It attempts to answer the questions: (1) Are the vocabularies found in textbooks of science actually too difficult for the pupils for whom the books are intended? (2) At what level do the difficult words begin to appear? (3) To what extent is their reading difficulty attributable to non-scientific, and hence, nonessential, words? (4) Do present textbooks of science provide adequately for the mastery of essential vocabulary through definition and repetition? (5) What are the important terms which should be mastered in the various courses of science?

The problem of reading difficulty is one of the most important in the entire field of education. Teachers will agree with Buckingham when he says "the author or editor who is so far removed from a knowledge of children as to use an adult vocabulary, does other things equally inappropriate." Many investigations have been made of children's vocabularies, one of the most important being Thorndike's revised list of the most important 20,000 words in English and American literatures (1931).

How large is a pupil's vocabulary at the different grade levels? Estimates vary. Thorndike thinks it to be from 10,000 to 11,500 words for the average high school freshman. Symonds says 13,800 words is the recognition vocabulary, but adds that the "recall" vocabu-

lary is only about one-third of that. Buckingham and Dolch say 10,000 at the completion of the freshman year. This is the situation when most of them enter biology. Because of lack of definite guidance in this, authors of textbooks have had to rely almost wholly upon their own judgments in selecting words with which to present their materials.

In the study being reviewed, it was found to be true that high school pupils had about as much difficulty with non-scientific words as with scientific terms. It was found that both types of words began to appear quite commonly in the seventh thousand-word level of Thorndike's Word Book. There is quite a concentration of them in the eighth and ninth thousand-word levels. This then, is the place where simplification should begin. It is at the junior high school period, at the end of which many drop out of school. Authors of textbooks should recognize the significance of these facts. One biology text was found to contain 617 rare words, that is, those not found in Thorndike's Teacher's Word Book. Pupils had to master these before they could understand the context. This was too much of a task—more than is required of a foreign language pupil. This evidence corroborates Power's earlier statement that "the vocabulary burden of all high school science texts is unnecessarily large."

"An objective of every course in science is to augment the vocabularies of the pupils by the addition of scientific, or technical, terms." The question now arises—how fast shall we present the new technical words to them in the senior high school, in order that they may make a success of their work and not become discouraged? If we knew this, there would be fewer failures and more students taking the science courses. A detailed study of thirty science texts showed, in the investigation, that all contained many difficult words. More-

over, a large percentage of these difficult words was used only once or twice. Scientific words were inadequately defined. It was found that the number of terms in the glossaries of biology texts ranged from 340 to 645. Some of these words are common, of course, to other sciences. A preliminary study was next made by having six judges mark a list of biology terms compiled from such glossaries. They marked the words either "essential," "desirable," or "neither." Only 27.4 per cent of the words on the list were marked "essential" by all the judges, who were chosen from high schools, normals, and universities.

A final study was made of the words considered essential and desirable by the subject-matter experts mentioned above. A list of these words was sent to selected high school teachers of biology in each state. Their names were recommended by their principals. They were asked to check the words as essential, desirable, or unsuitable. Each of these terms was carefully defined. It was emphasized that the words marked "essential" should constitute a minimum list of scientific terms, the definitions of which the

pupils should master before completing the course. The list was marked by 324 biology teachers, both men and women. Their average experience was 11.2 years. There were 825 words or terms on the list. Five hundred and fifty-nine of these were judged "essential" by more than half of these teachers.

Composite ratings were finally obtained by weighting the 825 words on the list, giving the essential words a value of 2, the desirable words 1, and the undesirable words −1. The results ranged from 644 points for *dicotyledon* to −116 for *Anseres*. Approximately half the terms on the list received a composite rating of 510 points. As a means of providing further guidance for authors and teachers, the entire list was divided into four approximately equal groups of words, representing descending levels of importance. Sample words from near the head of each list follow:

1 (essential)	3 (less desirable)
abdomen	adrenal
adaptation	albumen
annual	alternate
antenna	angiosperm
anterior	antibody
appendage	axon
artery	bast
bacterium	chromatin
beetle	cloaca
bile	cochlea
2 (desirable)	**4 (unsuitable)**
acquired	aerobic
adenoid	altricial
alimentary	amylopsin
aorta	Anura
aphid	archegonia
Arthropoda	blastula
asexual	caecum
auditory	choroid
auricle	dioecious
bacillus	ectoplasm

Teachers will recognize the utmost importance of this series of investigations, for elementary biology. It is fundamental in the success of our work. Get the

book and use it. Moreover, write your authors and publishers that this study must be used in future editions of our texts. All science texts should contain glossaries, and these glossaries should contain a large majority of the words in lists one and two.

J. L. SLOANAKER

BOGERT, CHARLES M. *Reptiles under the Sun.* Natural History 44: 26–37. June, 1939.

Contrary to popular belief, snakes and lizards cannot remain in strong sunlight for long periods of time. A rattlesnake can be killed in nine minutes or less by being forced to remain out of the shade. Reptiles escape the sun's force by several means: color change, food storage, speed of movement, tunnelling in the earth, hiding among rocks or other shelter, sight adaptation for nocturnal foraging, diving in sand, special temperature-detecting organs, and canyon dwelling. A study of the altitude ranges of reptiles on Mt. San Jacinto, in southern California, is also presented. The article is very well illustrated with photographs and diagrams.

LETTER TO THE EDITOR

May I suggest a question and answer column for our magazine and offer the first question?

I use the experimental method of teaching and need a reference guide to various experiments and activities that pupils may conduct. For example, what experimental work is feasible for high school students (10th grade) to do on Protozoa? Or how can students make permanent microscope slides with little equipment? Or how to go about microphotography? Is there a book to satisfy my needs?

(MRS.) MARGARET J. WITHERSPOON
Normandy High School,
St. Louis, Missouri

THE NATIONAL SCIENCE COMMITTEE

Is an outgrowth of the Department of Science Instruction of the N.E.A. It is composed of representatives of eight different groups. Its purpose is to formulate a program of science instruction for grades one to fourteen. In addition to the members of the committee some two hundred "consultants" are also working on the project. On May 12th and 13th, at the Cleveland meeting our association was voted a representative on the general committee. The selection of this representative will be a matter for the consideration of the Executive Board. The results of this work can be very helpful. Biology teachers should take their proper part of this work and assist with the formulation of this program. The outlook is very hopeful.

P. K. Houdek
Secty, Treas.

MIAMI VALLEY BIOLOGICAL ASSOCIATION

(Continued from page 17)

January 15.
WEATHER.
8:00 P.M. Dayton Y.M.C.A., Monument Avenue at Ludlow. Mr. Harry L. Guthrie, Dayton Weather Bureau Office, Leader.

February 5.
MENTAL HEALTH.
8:00 P.M. University of Dayton. Father John A. Elbert, Leader.

March 4.
PUBLIC HEALTH.
8:00 P.M. Dayton City Board of Health, U. B. Building. Dr. Williamson, Leader.

April 8.
8:00 P.M. The Samuel S. Fels Foundation for the Study of Prenatal and Postnatal Environment and the Kettering Foundation for the Study of Chlorophyll and Photosynthesis. Antioch College, Yellow Springs, Ohio. Dr. Lester W. Sontag and Dr. O. L. Inman, Leaders.

May 12 (Sunday).
Hike at 1:30 P.M., Lunch at 6:00 P.M. John Bryan Ohio State Park, near Yellow Springs, Ohio. Dr. Bodenberg, Wittenberg College, Leader.

THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS ☐ NEW
MR. P. K. HOUDEK, *Sec'y-Treas.* ☐ RENEWAL
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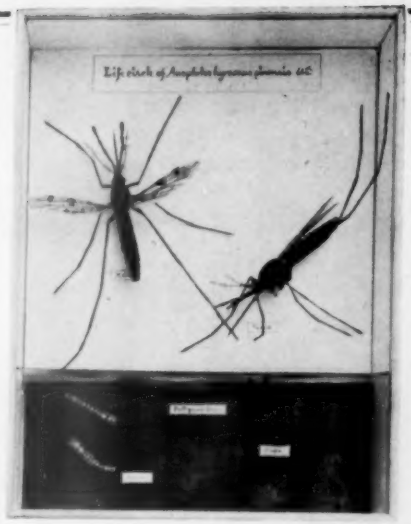
Local biology teachers association of which I am a member .....



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